

WHAT IS CLAIMED IS:

1. A diffraction element comprising a diffraction grating having a concave/convex shape in cross-section formed in a surface or both surfaces of a transparent substrate, wherein the diffraction element is adapted to receive light through the surface of the transparent substrate, which is opposite to the surface in which the diffraction grating is formed, in a case that the diffraction grating is formed in either one surface, and is adapted to receive light through the surface, in which the diffraction grating is formed in its central region, of the transparent substrate, in a case that diffraction gratings are formed in the both surfaces wherein a diffraction grating is formed in the central region of at least one of the surfaces.

2. The diffraction element according to Claim 1, comprising the transparent substrate and the diffraction gratings having a concave/convex shape in cross-section formed in the both surfaces of the transparent substrate, wherein an incoming-side surface, into which an external light is incident, in the both surfaces of the transparent substrate is provided with an incoming-side diffraction grating in its central region, and at least one outgoing-side diffraction grating is formed in an outgoing-side surface which is opposite to said incoming-side surface, and at least one of outgoing-side diffraction gratings is formed on the light path of the

external light diffracted by said incoming-side diffraction grating, and the grating pitch thereof is substantially equal to the grating pitch of the incoming-side diffraction grating.

5 3. The diffraction element according to Claim 2, wherein the diffraction grating is formed directly in the surface of the transparent substrate.

4. The diffraction element according to Claim 2, wherein the diffraction grating is formed in an inorganic film
10 formed on a surface of the transparent substrate.

5. The diffraction element according to Claim 2, wherein at least one of the outgoing-side diffraction gratings, whose grating pitch is substantially equal to the grating pitch of the incoming-side diffraction grating, is a
15 reflection type diffraction grating.

6. The diffraction element according to Claim 2, wherein at least one of the outgoing-side diffraction gratings, whose grating pitch is substantially equal to the grating pitch of the incoming-side diffraction grating, is a
20 diffraction grating having a saw-tooth like concave/convex portion or a pseudo sawtooth-like diffraction grating wherein a saw-tooth like shape is approximated by stairs.

7. The diffraction element according to Claim 6, wherein
25 in the pseudo sawtooth-like diffraction grating, the height or the depth of a step is different from the height or the depth of another step, these steps

constituting the stairs.

8. A reflection type diffraction element comprising the diffraction grating as described in Claim 1, wherein a reflective film is formed on the concave/convex portion
5 in cross-section of the diffraction grating formed in one surface of the transparent substrate and an antireflective film is formed on the surface of the transparent substrate, which is opposite to the surface in which the concave/convex portion is formed, whereby it
10 is adapted to receive light from the side of the antireflective film.

9. The reflection type diffraction element according to Claim 8, wherein a protecting member composed of an inorganic material or an organic material is provided on
15 the transparent substrate at the side of the reflective film so as to protect the reflective film.

10. The reflection type diffraction element according to Claim 8, wherein the transparent substrate is a glass substrate, and the concave/convex portion is formed
20 directly in a surface of the glass substrate or is formed in the inorganic material formed on the surface of the glass substrate.

11. The reflection type diffraction element according to Claim 8, wherein the cross-sectioned shape of the
25 concave/convex portion is a sawtooth-like shape or a shape in which a sawtooth-like shape is approximated by stairs.